Polar Cap Boundary Layer Waves: Location, Interplanetary Dependence and Nature

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Polar Cap Boundary Layer waves are ELF/ULF electric and magnetic waves detected on field lines just adjacent to the polar cap, thus their name. Waves are present at this location 96% of the time. The wave latitude-local time distribution is shown to be the same as that of the auroral oval. The most intense waves are detected coincident with the strongest magnetic field gradients (field-aligned currents). Local noon and midnight wave intensities are the greatest when the interplanetary magnetic field $B_z < 0$. Specific frequency bands of whistler mode-waves are identified: ~200 Hz, 1-2 kHz and ~5 kHz. Assuming resonant interactions, energies for electron and ion beams are derived. Two types of intense electric waves are present: solitary bipolar pulses (electron holes) and Langmuir waves. The PCBL waves are most likely a consequence of instabilities associated with auroral field-aligned currents. The currents have in turn been ascribed to be due to magnetospheric convection driven by the solar wind. One consequence of the presence of the waves at high altitudes is diffusion of magnetosheath plasma into the magnetosphere and magnetosphere plasma out into the magnetosheath.